



CITY OF KIRKLAND

Department of Public Works

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MEMORANDUM

To: Transportation Commission

From: David Godfrey, P.E., Transportation Engineering Manager

Date: May 20, 2011

Subject: Level of Service

Level of Service material we've covered recently:

January: Node idea is good for transit.
February: Transit: idea is basically okay as presented.
Bicycle: Commission offered a few additions/edits, but concept okay
March: No discussion this month
April: Walking: much discussion on whether or not node based system is best.
Commission offered suggestions for other factors to be included, notably safety, walkscore.com.

This memo recaps materials that we've covered and includes revisions to the bicycle and walking level of service calculations.

Transit

The transit level of service is presented below. The concept is that data is gathered, a system of points is devised that assigns values on the quality of various factors, then pairs of nodes are scored based on how the data translates into points. The next four pages show the system that's been discussed previously.

Transit Level of Service Example February 2011

Data

	Downtown			Houghton			Rosehill		
	Route	Transfer	Trvl Time	Route	Transfer	Trvl Time	Route	Transfer	Trvl Time
Bridle Trails	245	No	6	245	No	3	245 to/from 248 or 230	Downtown	10 to 15
Rose Hill	Route	Transfer	Trvl Time	Route	Transfer	Trvl Time			
	230,245	No	4 to 6	245 to/from 248 or 230	Downtown	10 to 15			
Houghton	Route	Transfer	Trvl Time						
	255, 238, 540, 245	No	3						

Span of Service data

Span	230 Freq	245 Freq		
Early 6:00 AM	30	30		
AM Peak		15		
Daytime		30		
PM Peak		15		
Evening	60	30		
Late 11:30	60	60		
Span	236 Freq	238 Freq	234 Freq	
Early 5:30 AM	30	30	30	
AM Peak				
Daytime				
PM Peak				
Evening 8:30		60	60	
Span	255 Freq			
Early 5:00 AM	30			
AM Peak	15-30			
Daytime	15			
PM Peak	15-30			
Evening	30			
Late 12:00	60			

Scoring factors

Quality factors:

weight		0.3	score	0.3	score	0.25	score	0.15	Score
<i>Quality</i>		<i>Transfer</i>		<i>Out of direction travel</i> $d = (actual-normal)/normal$		<i>Combined frequency</i>		<i>hours/day of service</i>	
Word	Number								
Very High	5	No	4	0	4.5	15 min or less	5	19 or more	5
High	4	No		0		15 to 30	4	17-18	4
Medium	3	Yes or no		$0 < d < 0.5$	3	30	3	15-16	3
Low	2	Yes	2	$0.5 < d < 1.0$	2	More than 30	2	4-14	2
Very low	1	Yes		$1.0 < d$	1	More than 30	1	less than 4	1

Other factors to think about

Load: is a seat available?
 Accessibility: can you get to the bus stop/destination
 Overall system coverage
 Quality by time of day
 Safety
 On time performance
 Cleanliness
 Facilities

Potential Span weighting factors for time of day quality assessment

<i>Period</i>	<i>Factor</i>
Early	0.05
AM Peak	0.25
Daytime	0.3
PM Peak	0.25
Evening	0.1
Late	0.05

Memorandum to Transportation Commission
May 20, 2011
Page 5

	Downtown						Houghton						Rosehill					
Bridle Trails	Route	Transfer	Distance	Frequenc y	Hours	Quality	Route	Transfer	Distance	Frequenc y	Hours	Quality	Route	Transfer	Distance	Freq uenc y	Hours	Quality
	245	4.0	4.5	3.0	4.0	3.90	245	4.0	4.5	3.0	4.0	3.90	245 to/from 248 or 230	2.0	1.0	3.0	4.0	2.25
Rose Hill	Route	Transfer	Distance	Frequenc y	Hours	Quality	Route	Transfer	Distance	Frequenc y	Hours	Quality						
	230,245	4.0	4.5	4.0	4.0	4.15	245 to/from 248 or 230	2.0	2.0	3.0	4.0	2.55						
Houghton	Route	Transfer	Distance	Frequenc y	Hours	Quality												
	255, 238, 540, 245	4.0	4.5	5.0	4.0	4.40												

Scored connections

Bicycle

The basic system is similar to transit. Travel between nodes is scored based on distance, elevation difference/distance and "barriers". Based on comment received in February barriers was expanded to include, auto volume and speed on the roadway, presence of bicycle lanes and out of direction travel as shown below:

weight		0.15	score	0.15	score	0.7	score
<i>Quality</i>		<i>Distance (miles)</i>		<i>Elevation diff /distance (feet/mile)</i>		<i>Barrier</i>	
Word	Number						
Very High	5	less than 2	5	less than 50	5	Sum value of barriers, subtract from 5	
High	4	$2 \leq d < 3$	4	$50 \leq e/d < 100$	4		
Medium	3	$3 \leq d < 4$	3	$100 \leq e/d < 150$	3		
Low	2	$4 \leq d < 5$	2	$150 \leq e/d < 200$	2		
Very low	1	5 or more	1	200 or more	1		

Barriers			points	
crossings/obstacles				
	70th/I-405		0.5	
	Kirkland Way bridge		0.25	
bike lane friction	volume		points/mile	speed >25 add .25
	30000		1.5	
	20000		1	
	15000		0.5	
No bike lanes	volume		points/mile	speed >25 add .25
	30000		5	
	20000		5	
	15000		3	
	10000		1	
Out of direction travel			0.3	points/mile

The previous bike scoring system is shown below:

Memorandum to Transportation Commission
May 20, 2011
Page 7
Data

10 mph

	Downtown					Houghton					Rosehill				
Bridle Trails	Route	Barriers	Distance	Time	Elev diff	Route	Barriers	Distance	Time	Elev diff	Route	Barriers	Distance	Time	Elev diff
	NE 70th Street, 6th Street, Kirkland Way	I-405/ NE 70th	2.8	16.8	440'	NE 70th	I-405/ NE 70th	1.7	10.2	440'	124th Ave - NE 80th - 122nd Ave - NE 70th	No	1.5	9.0	134
Rose Hill	Route	Barriers	Distance	Time	Elev diff	Route	Barriers	Distance	Time	Elev diff					
	Kirkland Way-6th Street-Railroad Ave-Kirkland Ave-80th overpass-80th-124th Ave	Steep grades Kirkland Way ERC bridge	1.8	10.8	306'	NE 70th - 120th Ave - NE 80th - 124th Ave	I-405/ NE 70th	1.7	10.2	132'					
Houghton	Route	Barriers	Distance	Time	Elev diff										
	Kirkland Ave - State St - NE 68th St	No	1.0	6	174'										

Memorandum to Transportation Commission

May 20, 2011

Page 8

Scoring factors

weight		0.15	score	0.15	score	0.7	score
<i>Quality</i>		<i>Distance</i>		<i>Elevation diff /distance</i>		<i>Barrier</i>	
Word	Number						
Very High	5	less than 2	5	less than 50	5	Sum value of barriers, subtract from 5	
High	4	$2 \leq d < 3$	4	$50 \leq e/d < 100$	4		
Medium	3	$3 \leq d < 4$	3	$100 \leq e/d < 150$	3		
Low	2	$4 \leq d < 5$	2	$150 \leq e/d < 200$	2		
Very low	1	5 or more	1	200 or more	1		

Barrier	points
70th/I-405	0.5
Kirkland Way bridge	0.25
steep grade to 80th overpass	0.05

Memorandum to Transportation Commission
May 20, 2011
Page 9

	Downtown					Houghton					Rosehill				
Bridle Trails	Route	Barriers	Distance	elev/di st.	Quality	Route	Barriers	Distance	elev/di st.	Quality	Route	Barriers	Distance	elev/di st.	Quality
	NE 70th Street, 6th Street, Kirkland Way	0.5	4.0	2	4.1	NE 70th	0.5	5.0	2	4.2	124th Ave - NE 80th - 122nd Ave - NE 70th	0.0	5.0	4	4.9
Rose Hill	Route	Barriers	Distance	elev/di st.	Quality	Route	Barriers	Distance	elev/di st.	Quality					
	Kirkland Way-6th Street-Railroad Ave-Kirkland Ave-80th overpass-80th-124th Ave	0.3	5.0	2	4.3	NE 70th - 120th Ave - NE 80th - 124th Ave	0.5	5.0	4	4.5					
Houghton	Route	Barriers	Distance	elev/di st.	Quality										
	Kirkland Ave - State St - NE 68th St	0.0	5.0	2	4.6										

Walking

Think of walking level of service as something that can be measured at any point, not just at a set of nodes.

Experts look at connectivity as a measure of walkability. Block length and intersection density are associated with connectivity. Therefore, a measure of intersection density was added. Also, trails and paths are added to centerline miles of roadway. Intersections will include places where any of the facilities used for centerline miles connect. Additionally, appropriate mid-block crosswalks will be added as intersections. Adding the crosswalks will address the safety element and help better represent block length.

The measures above describe the quality of the network that is available for walking. Sites like walkscore.com describe the amount, type and proximity of amenities that are available to walk to. There is an advanced version of walkscore.com that uses network connectivity rather than "as the crow flies" to calculate the score. Details of how walkscore.com works are [here](#). Walkscore.com values have been added to the matrix.

Potential Walkability scores May 20, 2011

Factor (within 1/4 mile crow flight)	Explanation	Nodes			
		Houghton	Bridle Trails	Rose Hill	Downtown
Number of businesses	More businesses generally implies more destinations. This number does not depend on type or size of businesses.	113	54	113	313
Street and trail Centerline miles	More streets means more opportunities for connectivity and better walkability	3.48	2.88	3.05	5.28
Fraction of streets with sidewalks complete on at least one side	Indicates the amount of sidewalk completion.	82.7%	56.4%	51.5%	75.3%
Fraction of "barrier" streets	Barrier streets are those where a marked crosswalk alone would not be adequate to provide a crossing.	21.5%	8.7%	24.6%	9.1%
Number of intersections	All intersections of facilities counted in street and trail centerline miles. Also include appropriate crosswalks on barrier streets	18	14	8	38
Intersection density	estimated as number of intersections per centerline mile of streets and trails	5.2	4.9	2.6	7.2
Walk score	As calculated by Walkscore.com http://www2.walkscore.com/pdf/WalkScoreMethodology.pdf Beta walk version	79.0	78.0	91.0	93.0

Kirkland Juanita Walk Score: **60** [Close](#)

The map displays the following neighborhoods and landmarks:

- Neighborhoods:** Juanita, South Juanita, Crestwoods, Highlands, Norkirk, Market, North Rose Hill, Moss Bay, Everest, Central Houghton, South Rose Hill.
- Streets:** NE 124th St, NE 116th St, NE 106th St, NE 85th St, NE 80th St, NE 70th St, NE 60th St, NE 68th St, 16th Ave, Central Way, Market St, 98th Ave NE, 124th Ave NE, 132nd Ave NE, 102nd Ave NE.
- Landmarks:** Totem Lake, Lake Washington, Lakeview, Lake Washington, Lakeview, Lake Washington, Lakeview, Lake Washington, Lakeview, Lake Washington.
- Other:** Juanita Beach Park, Lake Washington Technical College-Kirkland Campus, North Rose Hill Park.

The map on the next page is from the Active Transportation Plan and it shows proximity to transit, parks, schools and commercial areas. Darker areas have more proximity.

